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Design thinking - Value Innovation - Deductive Reason and the Designers Choice

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This paper is an introduction to a series of six papers concerning the modelling of design problem space. It explores the designer's development of value through the use of deductive reason and subjective choice in the construction of design problem space.

The author contrasts a hierarchic view of decision-making based on deductive reason with a parameter framing approach based on the cognitive modelling of problem space. Choice-inclusive and choice-exclusive decision making processes are considered with regard to their implication on responsible design practice. Potential for innovation is related directly to the problem framing process that provides the bounds in which the instability of the creative process can occur.

Note: In this paper design is considered in a domain-independent form and designers are those involved in design thinking.

Context

In 1976 Bruce Archer offered a model of Design as a significant and distinctive dimension of human activity. He identified the essential distinction of the practice of Design and of the act of designing as being modelling (or cognitive modelling) and put Design in the context of Science and the Humanities.

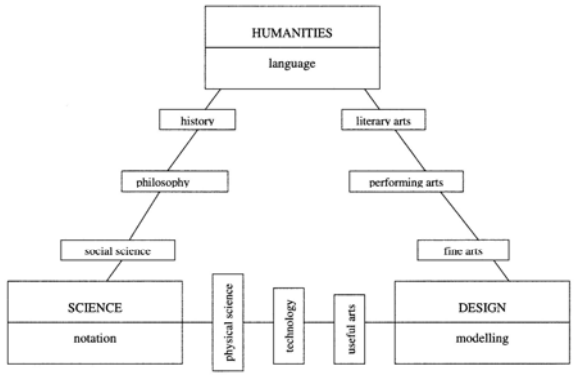

Figure 1: Design as a 'third area' [Source: Design in General Education (1976) pp15-16]

At the 1980 Design Research Society conference it was postulated that Design can be described as a combination of both Artistic and Scientific thinking and that neither Art nor Science alone can adequately describe what design (as a process) is.

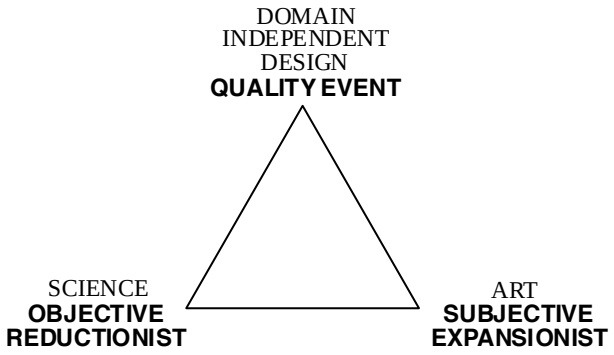

Figure 2: Design as a third area [Source:Woollatt/English unpublished 1994]

The conference suggested that perhaps there was not so much for design to learn from science after all, and that perhaps science had something to learn from design.

As Archer wrote in his paper for the 1980 conference

'Design, like science, is a way of looking at the world and imposing structure upon it'.

Subjects, Objects and the Metaphysics of Quality

Traditional philosophy divides the world into *objects* and *subjects*, which are essentially *things* and *observers* respectively (A subject is an observer and an object is a thing observed). Stamford Encyclopaedia of Philosophy describes such an object as '*anything that we can think'*. So 'we' refers to us humans as subjects (as sensing beings) and 'anything' refers to things as objects *(i.e. 'anything we can talk about')*. *A* subject therefore is a being that has subjective experiences or a relationship with another entity (or object).

The world according to Plato's Phaedrus consists of Mind, Matter and Quality (Persig 1974). Here Quality is found in the relationship between the subject and the object – Quality is not a thing but an event. We might map this onto our traditional philosophical view as shown in figure 3:

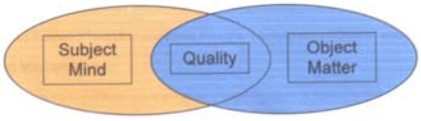

Figure 3: Mind Matter and Quality

Popper's 3 worlds of mankind (1973) describe mind and matter in a way that is analogous to Plato's Phaedrus but Poppers 3rd reality is a world of shared concepts. This world of shared concepts is both like quality (as it is based on people's shared experience of things) and unlike quality because it is essentially a conceptual language notation. Pinker (1994) describes this as our '*language instinct'* arising from our shared human experience (same objects experienced by the same generic subjects i.e. humans)

1. the physical or world of physical states.

2. personal experience.

3. mental concepts.

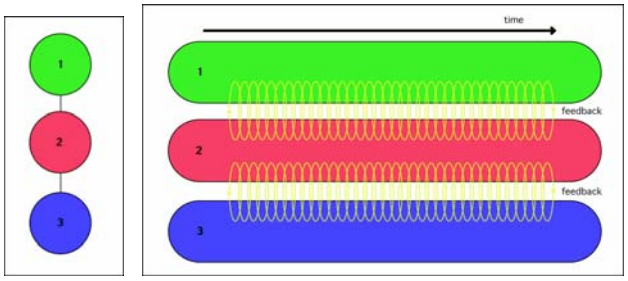

Figure 4: Pluralism, the '3 Worlds' of mankind. [Source: Spencer 2006 unpublished : ref Popper (1973) Objective Knowledge. Oxford University Press (p 106-190)]

Pirsig (1973) suggests that the Metaphysics of Quality is a better lens through which to view reality than the traditional dualistic subjective/objective mindset.
Whilst Poppers 3rd world is conceptual Persig's 'Metaphysics of Quality' encapsulates both mind and matter.

A model for objective deductive reasoning in design

Aristotle's Organon on logic (Smith 2004) indicates a general form for deductive reasoning as a process of drawing explicit conclusions from evidence i.e. drawing conclusion based on what we know, for example:
J comes before K in the alphabet
C and G comes before J
Thus CG comes before K

Our process of reasoning is based both on how we perceive the evidence (leading to our concept of it) and the method by which we assimilate it.

This is a valuable thinking tool as it gives us a structure to quickly work out how to act.
If we have never seen a bus before we might reason:
I should get out of the way of fast moving things on the road
A bus is moving fast down the road
Thus I should get out of the way of the bus

This process of deductive reasoning gives rise to hierarchic thinking patterns.
In diagrammatic terms we might describe deductive reason as shown in figure 5:

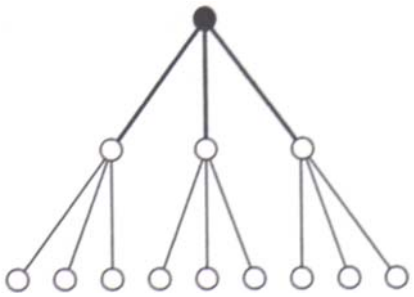

Figure 5: Hierarchy of deductive reason.

A hierarchy of concepts each of which relates to another in some way.
In this hierarchy we might say that the top concept ● is four legged mammal, the next concept ○ is horse and the next concept ○ is palomino.

All horses are four legged mammals
A palomino is a horse
Therefore a palomino is four legged mammal

The model could also be applied to reasoned deductions or certain forms of decision.
E.g. the reason ● I am climbing this mountain is to get to the top,
Therefore I *decide* ○ *to* wear walking boots and ○ carry a flag to stick in the summit.
Reason takes no account of personal experiences had along the way or of the quality of the view at the top.

When we apply deductive reasoning to the way we create things JC Jones (1970) describes decision making in a hierarchy of decisions. If we want to create a car and the reason for this ● is to get from A to B as fast as possible then ○ might be that it has a massive engine and ○ that it uses a large amount of fuel or ○ the construction is lightweight and ○ there is no luggage space.

Undesirable outcomes might therefore be the consequence of achieving our objective by deductive reasoning. We can discount the fact that the car might be unsafe or that it's environmentally unfriendly because of the reason.

We might also use deductive reason in a negative sense:
When we apply the model to the way we live our lives we start to disempower ourselves, we say "the reason I am doing this is because of ●." or "I can't do that because of ● reason".
I have to work long hours to earn a living
I want to spend time with my family
Earning a living leaves no time for my family

We reason by linking concepts and creating sequences but as well as making us quicker and more efficient decision makers this also blinkers us and makes it difficult to appreciate unreasonable conclusions.
Design decisions made through deductive reason are unemotional, as this process does not involve the designer taking on the responsibility for the outcome.
The responsibility lies purely with the reason and it is the reason that is responsible for what happens allowing the human to disengage him or herself.

Design thinking however is not like this. Design as Archer postulated is not entirely objective oriented, it is people oriented.

A model for Design
A design process involves a person saying **I** am going to **create** **something** for **people**
I – the design thinker's Choice – both conscious and subconscious
Create – the Process (cognitive modelling of problem space)
Something – the Object
People - the Subject

As design thinkers we do not completely objectively identify what the process will create but rather paint a picture of where the answer might lie. We do this by considering the issues to do with the subject/object interaction and gradually creating a set of parameters, which define the space in which the solution is estimated to be. This is referred to as the 'problem space' (or by some researchers as 'solution space') (e.g., Langan 2002).

Problem Space – thinking about the problem
Asked what he would do with only one hour to save the world Albert Einstein said 'I would spend 55 minutes defining the problem and five minutes solving it'.
Dorst (2004) states 'The main paradigm of design methodology, in which design is seen as a rational problem solving process, was introduced by Simon in the early 1970s. In this paradigm, design is viewed as a rational search process: the design problem defines the 'problem space' that has to be surveyed in search of a design solution.'

Schön (1983) identifies the importance of 'problem framing' in design and this is recognised by DeBono (1967) as a key to 'lateral thinking.

According to most design researchers, (Langan 2002) a design method should contain the following representations:

- ***Design problem space representation***
- ***Design solution space representation***
- ***Design knowledge representation***

In Simplex innovation process (Basadur 2000) problem space is described in terms of sectors 1, 2 and 3 in the following model:

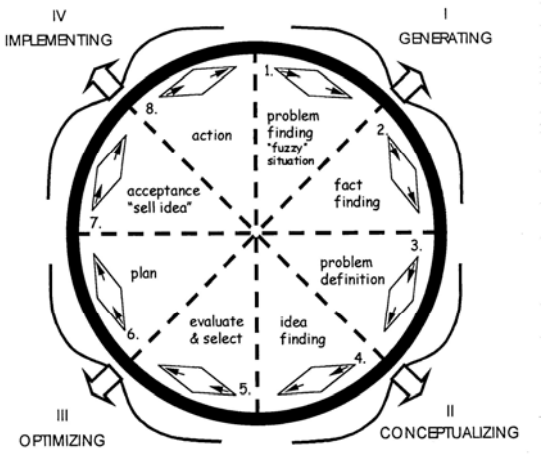

Figure 6: Simplex Innovation process [source: Basadur,Pringle,Speranzini,Bacot 'Collaborative problem solving through creativity in problem definition: Expanding the pie.' Creativity and Innovation Management Volume 9, Number 1, March 2000 (Blackwell publishers)]

Some investigators have posited a domain-independent representation for knowledge called the *problem space* (Fikes, R., Nilsson, N. 1971). Problem spaces are commonly composed of a set of goals, a state or set of states, and a set of valid operators, which contain the constraints under which the operator can be applied.

The problem space is something that the designer builds with a combination of tangible and non-tangible concepts. Tangible concepts are quantitative and objective and might relate to materials, manufacture, cost, function. Non- tangible concepts are qualitative and subjective and are often based on what the designer has learned about how they and other people perceive things; these could include value, meaning, sensory qualities, and emotions.

In this diagram a pool of parameters chosen by the designer on the basis of a design brief, research into the context for the design and the designer's experience of ways of seeing the problem represent the problem space.

Figure 7: Pool of Parameters

The designer builds their own problem space from two types of things. Firstly the things that have to be, these are derived from directions the designer receives in the form of a brief combined with the designer's own knowledge of the social meaning and physical restrictions of the situation. Secondly the things that the designer wants to be, these are purely what the designer chooses (either consciously or subconsciously) to include in the mix.

The problem space describes all the potential solutions available to the designer however the eventual proposals are dependent on the designer's choice.

This diagram represents the problem space out of which the designer 'creates' ◯.

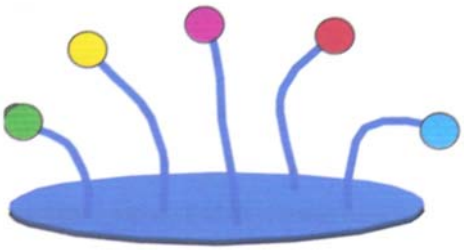

Figure 8: The designers choice

A Story of Decisions and Choices

There was once a very good student who had almost completed a long and complex design problem. He had dealt with all the difficult problems of the brief and had answered all the questions posed by the assignment. However during the final few weeks of the project he could neither decide what colour it should be or whether it should have a 2cm radius or a 3cm radius. He was a hard working student and put all his effort into this decision but in the end he just could not get it right and threw the whole project off the Tyne Bridge.

This story illustrates the difference between a design decision made as the result of a reason and a design choice made because the designer said so. No matter how hard this student tried he could not find a reason with which to make a decision, as a result the choice that was available to him was never made.

Inexperienced design thinkers often get stuck on choices, as there is no external influence causing an aspect of their design to be a certain way.

The Self-Conscious Designer

The expert designer has to be adept at distinguishing between what has to be with what does not have to be. An expert designer and a not so expert designer were both asked to design an iron. When the not so expert designer created his problem space he thought "iron", for use with an ironing board, handle, base-plate, electric, heat settings. As you might imagine all of his resulting designs had a handle and a base-plate and worked like any conventional iron by pressing the fabric of the garment. The expert designer however did not include any preconceived ideas in building a problem space; instead she asked 'how can I remove the creases from garments'. The expert designer presented a wide variety of innovative concepts a few of which had a handle and a base-plate. The not so expert designer asked 'how did you come up with such innovative ideas?'

In a recent study investigating the creative thinking process of expert designers *Victor Scheinman, Kenneth Grange and Gordon Murray,* Nigel Cross (2004) states:
'all three designers appear to explore the problem space from a particular perspective in order to frame the problem in a way that stimulates and pre-structures the emergence of design concepts.' The existence of the whole context of a design problem – perhaps subconsciously in the mind of an experienced designer clearly needs to be 'self-conscious'. As Stacey (1993) states 'Choice and creativity are,.. confined to consciousness'

Problem space provides a plateau for the convergent stage of the thinking process and sets up a state of bounded instability in which creativity can occur. Stacy (1993) demonstrates this as an effective organisational tool for business innovation. As he concludes 'The discoveries [of Chaos and Complexity] also mean that creativity arises out of instability. Looking at the world in this new way helps us to see why instability and unpredictability are essential to innovation and creativity.'

Conclusions

This paper postulates a way of seeing Design as *the responsible human creation and communication of real future possibilities within defined limits.*

It describes deductive reason as an efficient, personally effective and comfortable process of decision-making that divorces the decider from the decision and gives responsibility to the reason. 'I did it because of cost/speed/manufacture….'
Whilst meeting a specific objective this might also result in undesirable consequences.

Design demands human choice and therefore human responsibility, as a way of thinking its value is in its influence on human engagement, empowerment and responsibility.
Design answers are generated as a consequence of the way we think about the problem not what we do to that information. Innovation occurs not by generating ideas but through awareness of what is possible.
If we know little about ourselves the basis of our choices and the nature of our assumptions may fall into that 'fuzzy' area designers call the 'black art'.

Sequential and hierarchic thinking provides us with very few possibilities. We need to find ways to structure our thought so that, in the same moment, many possibilities can exist. Only then can we truly choose our own futures responsibly.

Further Research

In the west we have developed something of a fixation with objective reality – i.e. the existence of an objective world outside ourselves – we conjecture that we merely experience that world as we pass through it.
However the realm of design is rather more concerned with subjective reality and the interaction of that subjective reality with objects. The intrigue of design being in its influence over the state of mind of the user.
We might therefore become better designers by knowing more about our subjects, the way that people experience the world, what they perceive through that experience and what they make that mean.

Areas for further investigation might include:

- Human sensory capacity, our mechanisms for experiencing the world and the extent of our consciousness.
- How we create our perception of the world particularly in relation to our construction of problem space and solution space. *This is further explored by the author in a paper titled 'Creating Universal Form' (English 2006)*
- Ways of seeing. Cognitive modelling.
- Reflective design practice. Developing our awareness of the choices we make as designers.

Some further questions

The designer might choose to use a particular texture because it feels good, alternatively he might decide on that same texture because it is non-slip and the design must be gripped.

If we were to consider real-life cases with a view to distinguishing decisions made through deductive reason from choices made by the expert designer we might be able to ascribe qualities to each and pose questions for further investigation, for example:

How is design value influenced by deductive reason or by the designer's choice?

What are the consequences of objective oriented deductive reasoning in design?

Do some designers make more choices than others?

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